

Act II: Testing UAr in SCENE

Weekly Update 12/17/14

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Run Overview

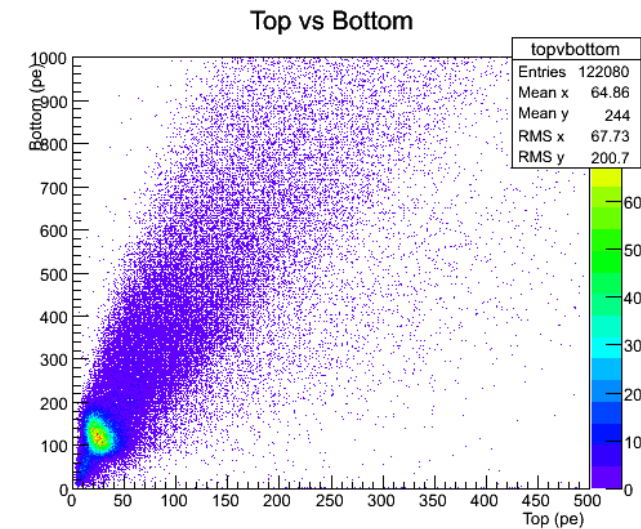
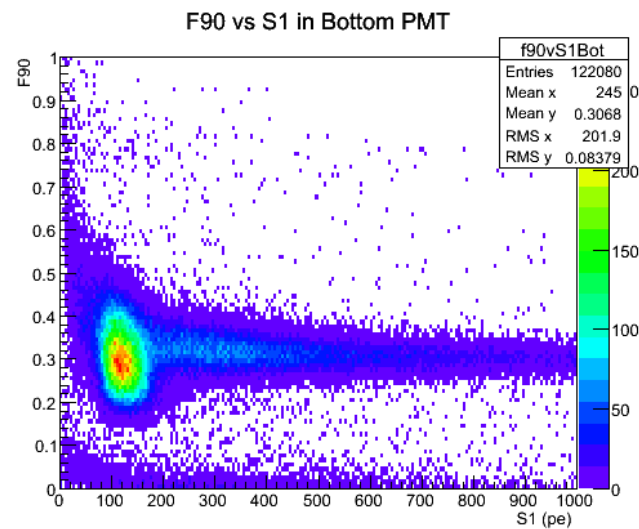
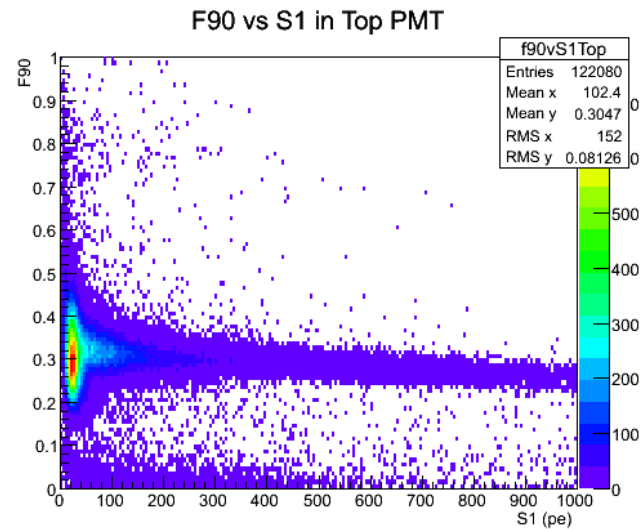
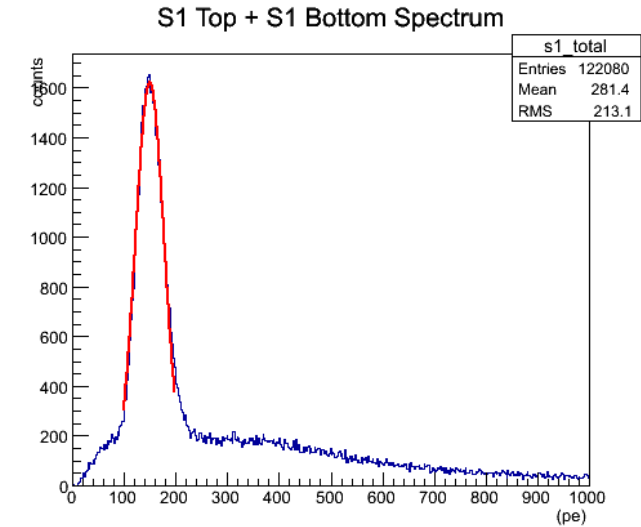
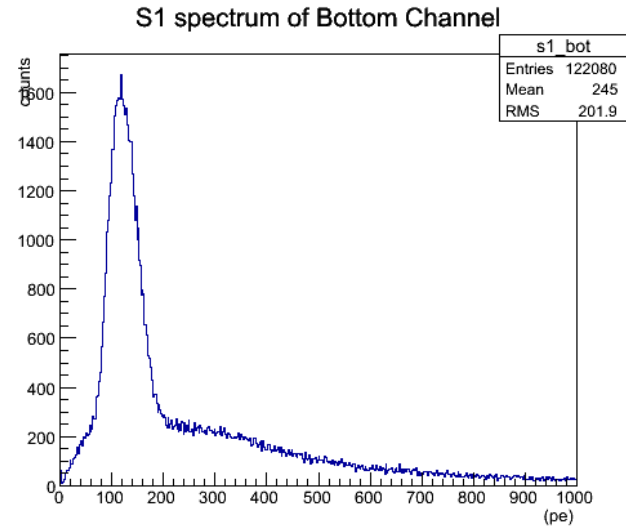
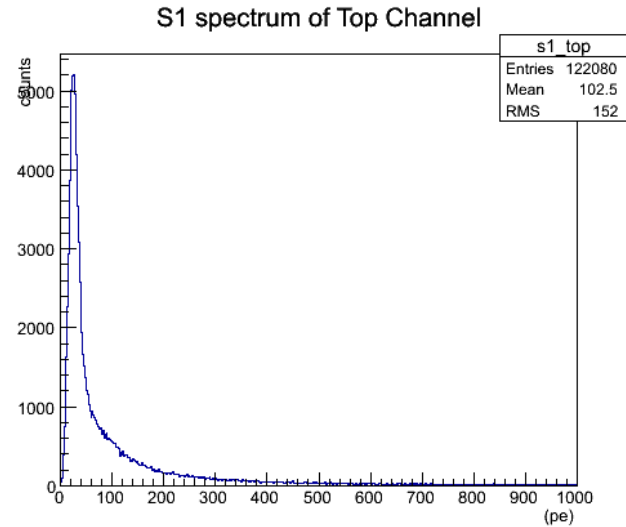
- Began filling Dec 13th, with first data runs beginning at 1:42 AM December 14th. S1 only data, liquid level above face of TOP PMT. Vigorous recirculation, 6 slm with the heater on the bottom at 27W.
- S2 data collection began 26 hours later. Vigorous recirculation continued while data was collected for 16 hours, then recirc was dropped down to 3 slm, 3W. Finally, bottom heater was turned off completely for 4 hours.
- Following disappointing signal with a calm TPC, studied liquid level issues for about an hour, decided against adding gas and began recirculation at 3slm/3W.
- Deciding to focus on data analysis rather than collection, vigorous (6slm/27W) recirculation resumed for 13 hours.
- Anode was turned off and S1 only data was taken, with the drift varying. Liquid level was at S1+S2 levels.

Analysis Method

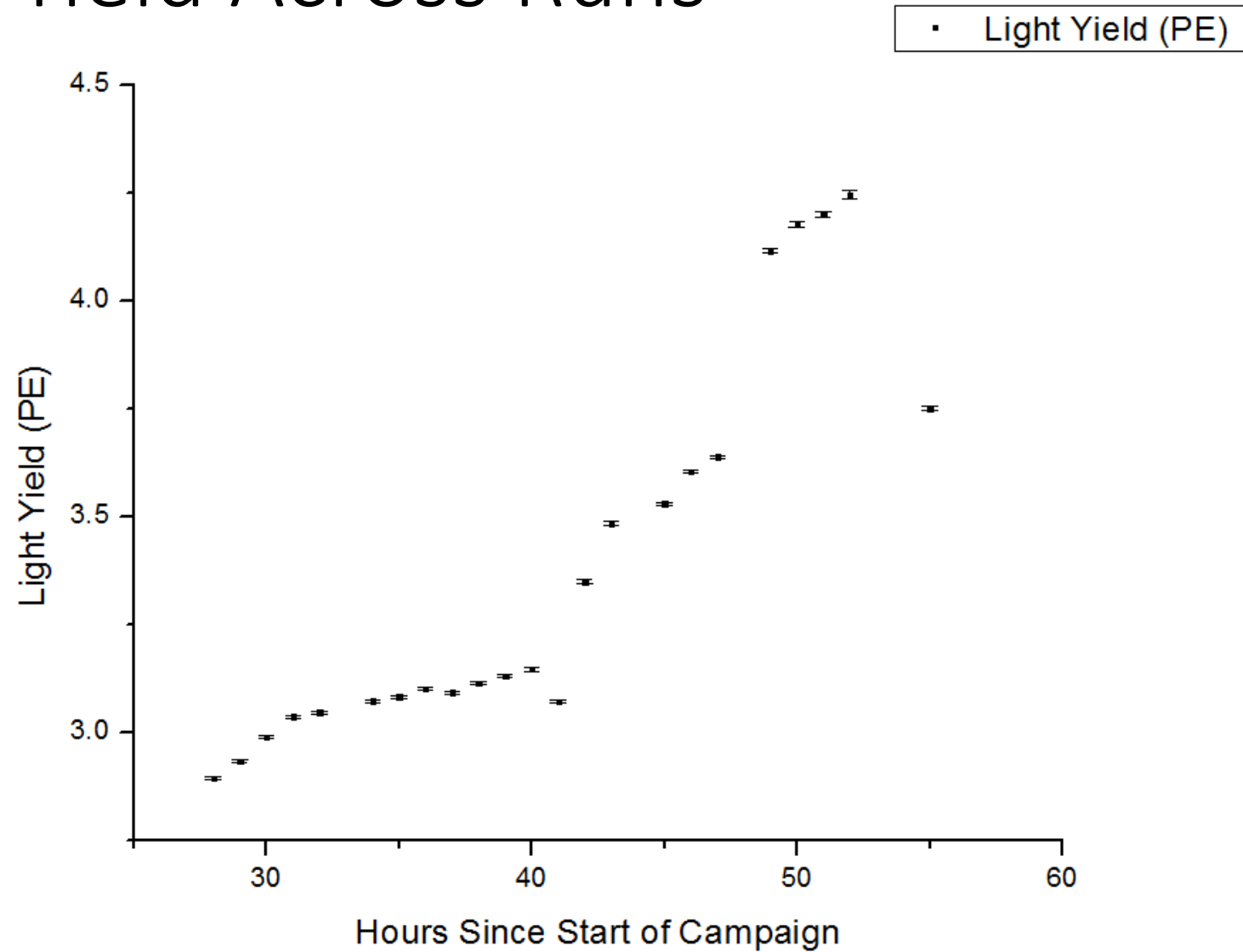
- Identify ^{83}Kr peak in S1 by finding highest bin, then fit a Gaussian 60 PE in both directions.
- Using that identified peak, select S2 events based on drift time, S1 Signal. Account for skew of events near the bottom.
- For those ^{83}Kr events, plot drift time vs S2 signal
- Fit gaussians to slices along the S2 axis to find the mean of each S2 peak.
- Fit an exponential across those means to find the electron drift lifetime.

Light Yield

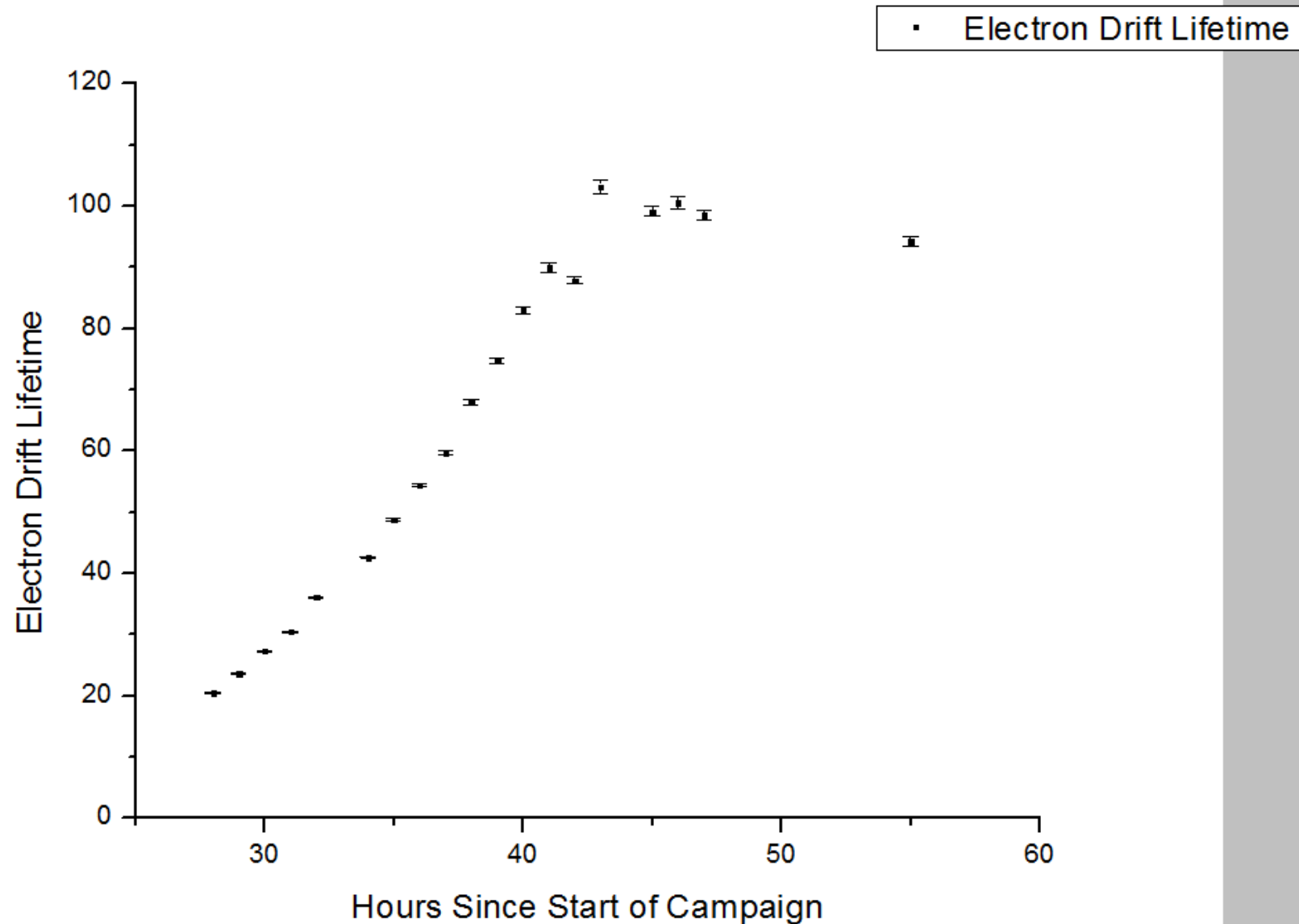
Example from Run000143



Light Yield Across Runs



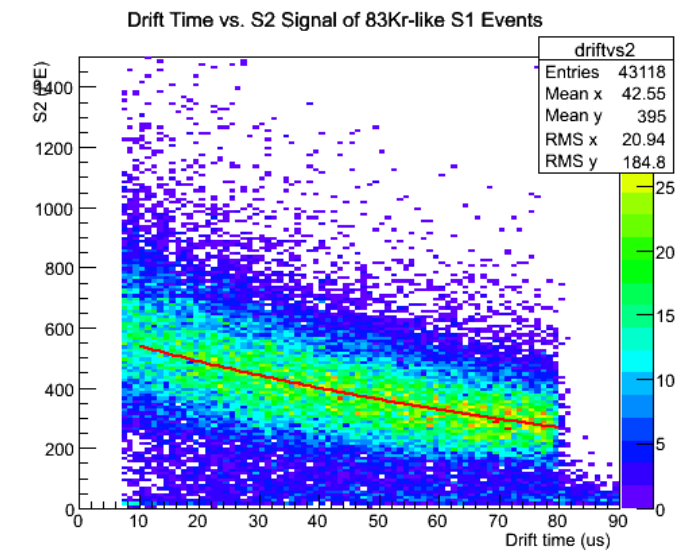
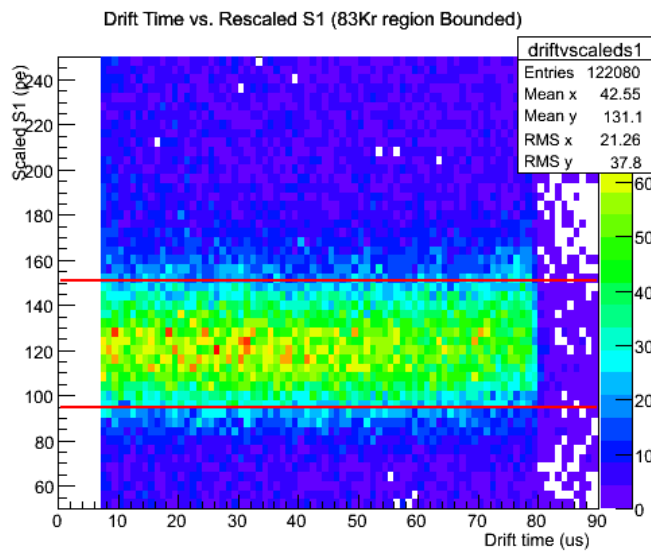
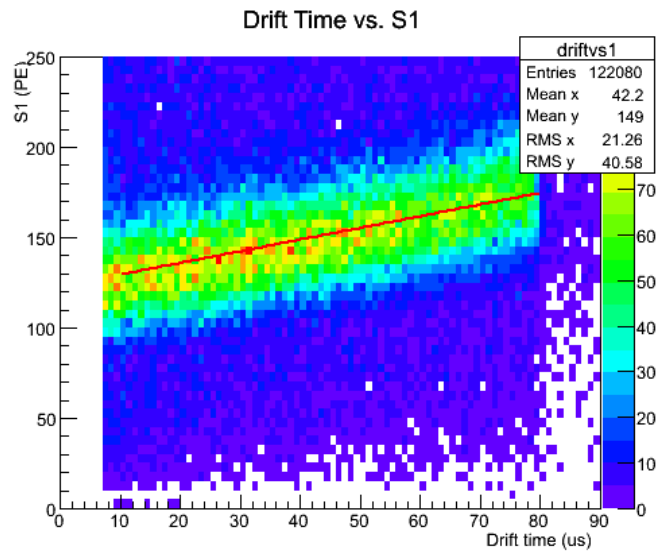
Electron Drift Lifetime Across Runs



Electron Drift Lifetime

Example from Run000143

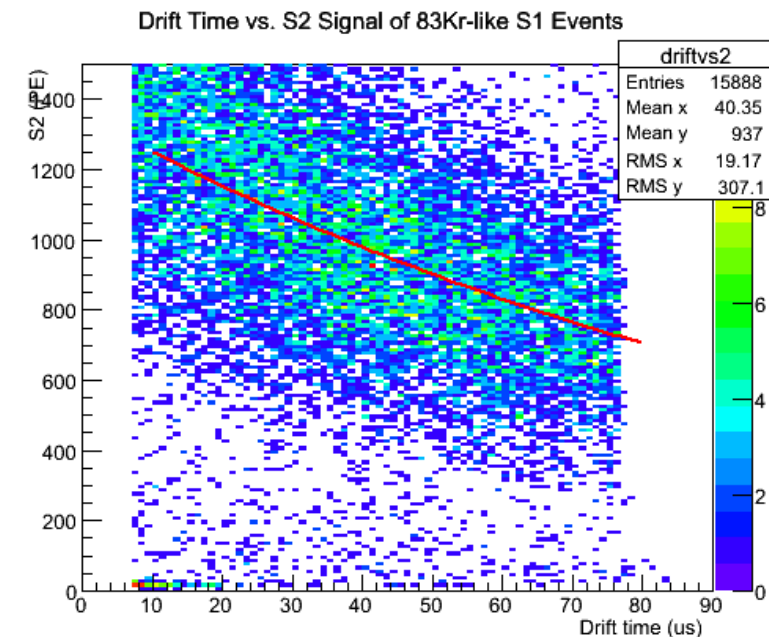
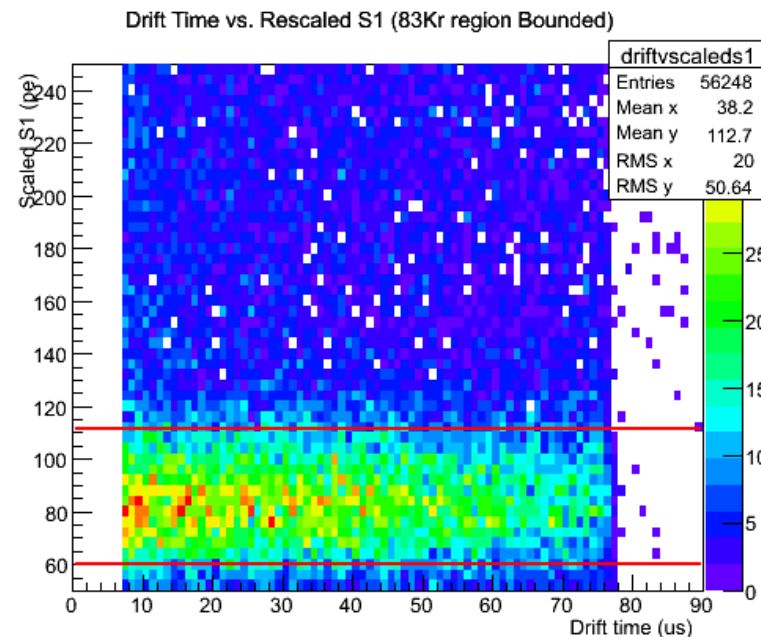
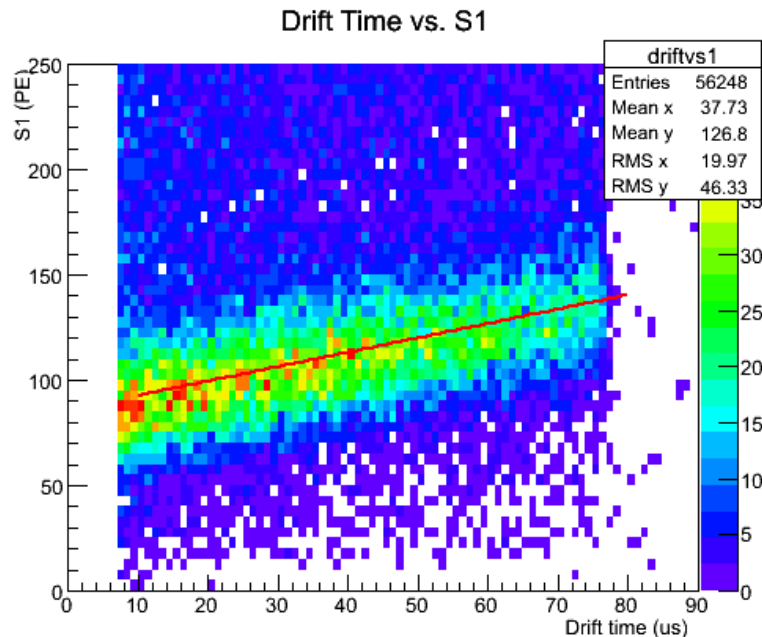
Lifetime = 100 ± 1 microseconds



Vs Atmospheric Run...

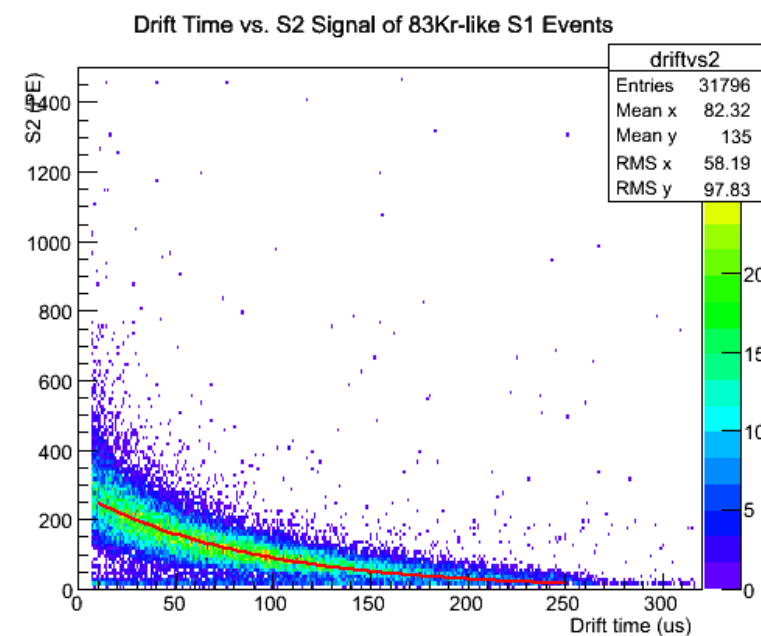
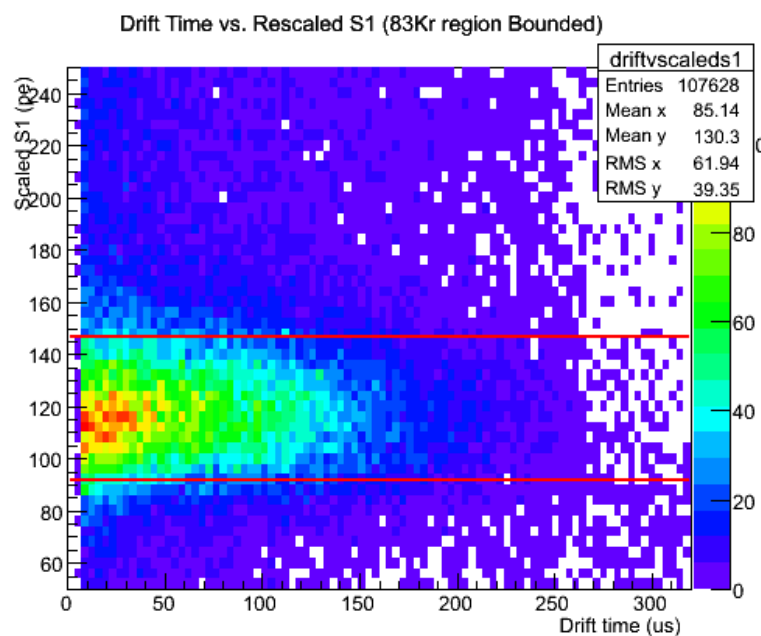
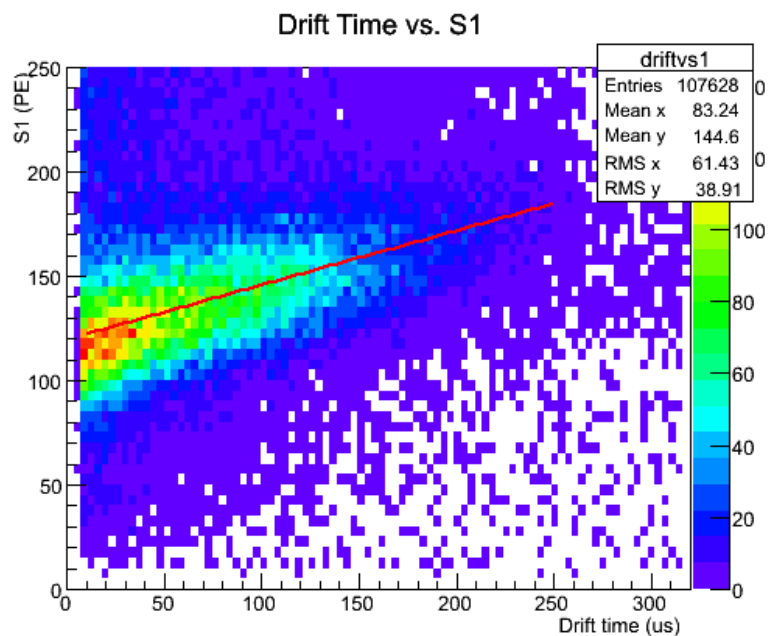
Lifetime = 122 ± 4 microseconds

Much smaller S2 signal, but better light yield. I believe this to be an Operator Error. I did not want to be adjusting the liquid level while I was watching the lifetime improve. I also didn't want to just use UAr willy-nilly.



Long Drift run (Drift V=50V/cm)

Lifetime = 87.8 microseconds



Ongoing work...

- As I said, the Light Yield's are bound to a bit of change. I did not have time to preprocess each run with it's unique SPE_mean calculation.
- Still need triplet state lifetime from AverageWaveforms. Ongoing...
- These plots could be a bit more precise! Sorry. I need to show when I change the recirculation environment.

Conclusion

- Bottle UAr #3 was used to test the viability of the UAr in a dual-phase TPC.
- Both Scintillation and Ionization has been observed in the first 50 Hours that is similar to a previous run using atmospheric argon
- Zirconium gettering appears to be effective method of cleaning the argon